

Name \_\_\_\_\_

Period \_\_\_\_\_

# **Chemistry I**

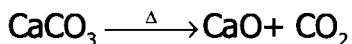
# **Stoichiometry**

## **2013**



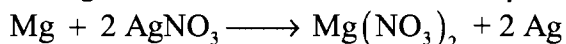
Stoichiometry Problem Worksheet A **Show ALL work for stoichiometry problem**

1. How many moles of calcium oxide can be prepared from 5 moles of calcium carbonate?



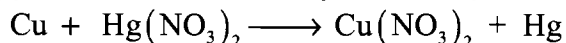
$$5 \text{ mol CaCO}_3 \times \frac{1 \text{ mol CaO}}{1 \text{ mol CaCO}_3} = 5 \text{ mol CaO}$$

2. How many moles of magnesium metal are needed to produce 1.0 mole of silver metal?



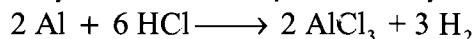
$$1 \text{ mol Ag} \times \frac{1 \text{ mol Mg}}{2 \text{ mol Ag}} = 0.5 \text{ mol Mg}$$

3. If 5.5 moles of copper react with mercury II nitrate, how many moles of mercury are produced?



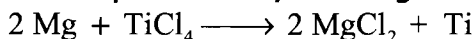
$$5.5 \text{ moles Cu} \times \frac{1 \text{ mol Hg}}{1 \text{ mol Cu}} = 5.5 \text{ mol Hg}$$

4. When 6.5 moles of aluminum metal react with hydrochloric acid, how many moles of aluminum chloride are produced?



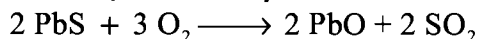
$$6.5 \text{ mol Al} \times \frac{2 \text{ mol AlCl}_3}{2 \text{ mol Al}} = 6.5 \text{ mol AlCl}_3$$

5. How many moles of titanium metal are produced by reacting 15.00 moles of titanium chloride with magnesium?



$$15 \text{ moles TiCl}_4 \times \frac{1 \text{ mol Ti}}{1 \text{ mol TiCl}_4} = 15 \text{ mol Ti}$$

6. If 4.8 moles of lead sulfide are roasted, how many moles of sulfur dioxide are produced?



$$4.8 \text{ moles} \times \frac{2 \text{ mol PbO}}{2 \text{ mol PbS}} = 4.8 \text{ mol PbO}$$

7. How many moles of hydrogen chloride are produced when sulfuric acid reacts with 19.0 moles of pure sodium chloride?  $2 \text{ NaCl} + \text{H}_2\text{SO}_4 \longrightarrow 2 \text{ HCl} + \text{Na}_2\text{SO}_4$

$$19.0 \text{ mol NaCl} \times \frac{2 \text{ mol HCl}}{2 \text{ mol NaCl}} = 19.0 \text{ mol HCl}$$

8. In the decomposition of 144 moles of water by electrolysis, how many moles of oxygen gas are produced?  $2 \text{ H}_2\text{O} \xrightarrow{\text{electricity}} 2 \text{ H}_2 + \text{O}_2$

$$144 \text{ mol H}_2\text{O} \times \frac{1 \text{ mol O}_2}{2 \text{ mol H}_2\text{O}} = 72 \text{ mol O}_2$$

9. How many moles of hydrogen chloride can be made from 0.75 moles of  $\text{Cl}_2$ ?  $\text{H}_2 + \text{Cl}_2 \longrightarrow 2 \text{ HCl}$

$$0.75 \text{ mol Cl}_2 \times \frac{2 \text{ mol HCl}}{1 \text{ mol Cl}_2} = 1.5 \text{ mol HCl}$$

10. How many moles of  $\text{Cl}_2$  are produced from 6.75 moles of hydrogen chloride?  $4 \text{ HCl} + \text{O}_2 \xrightarrow{\text{electricity}} 2 \text{ H}_2\text{O} + \text{Cl}_2$

$$6.75 \text{ mol HCl} \times \frac{1 \text{ mol Cl}_2}{4 \text{ mol HCl}} = 1.69 \text{ mol Cl}_2$$

11. How many moles of sulfur are needed in the production of 1800 moles of sulfur dioxide? (What's the mole ratio?)  $\text{S}_8 + 8 \text{ O}_2 \longrightarrow 8 \text{ SO}_2$

$$1800 \text{ mol SO}_2 \times \frac{1 \text{ mol S}_8}{8 \text{ mol SO}_2} = 225 \text{ mol S}_8$$

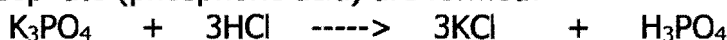
12. How many grams of sodium bromide are needed to make 50 grams of bromine gas from sodium bromide?  $2 \text{ NaBr} + \text{Cl}_2 \longrightarrow 2 \text{ NaCl} + \text{Br}_2$

$$50 \text{ g Br}_2 \times \frac{1 \text{ mol Br}_2}{160 \text{ g Br}_2} \times \frac{2 \text{ mol NaBr}}{1 \text{ mol Br}_2} \times \frac{103 \text{ g NaBr}}{1 \text{ mol NaBr}} = 64.4 \text{ g NaBr}$$

13. How many grams of potassium permanganate are needed to produce 1.75 moles of manganese chloride?  
 $16 \text{ HCl} + 2 \text{ KMnO}_4 \longrightarrow 2 \text{ MnCl}_2 + 2 \text{ KCl} + \text{H}_2\text{O} + 5 \text{ Cl}_2$

$$1.75 \text{ mol MnCl}_2 \times \frac{2 \text{ mol KMnO}_4}{2 \text{ mol MnCl}_2} \times \frac{158 \text{ g KMnO}_4}{1 \text{ mol KMnO}_4} = 276.5 \text{ g KMnO}_4$$

14. If 120 g of potassium phosphate react with hydrogen chloride, how many grams of hydrogen phosphate (phosphoric acid) are formed?



$$120 \text{ g K}_3\text{PO}_4 \times \frac{1 \text{ mol K}_3\text{PO}_4}{212 \text{ g K}_3\text{PO}_4} \times \frac{1 \text{ mol H}_3\text{PO}_4}{1 \text{ mol K}_3\text{PO}_4} \times \frac{98 \text{ g H}_3\text{PO}_4}{1 \text{ mol H}_3\text{PO}_4} = 55.5 \text{ g H}_3\text{PO}_4$$

15. When 80.0 grams of sodium carbonate react with calcium hydroxide, what mass of calcium carbonate is produced?



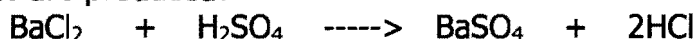
$$80 \text{ g Na}_2\text{CO}_3 \times \frac{1 \text{ mol Na}_2\text{CO}_3}{106 \text{ g Na}_2\text{CO}_3} \times \frac{1 \text{ mol CaCO}_3}{1 \text{ mol Na}_2\text{CO}_3} \times \frac{100 \text{ g CaCO}_3}{1 \text{ mol CaCO}_3} = 75.5 \text{ g CaCO}_3$$

16. If 90.0 grams of sodium chloride react with sulfuric acid, how many grams of sodium sulfate are produced?



$$90 \text{ g NaCl} \times \frac{1 \text{ mol NaCl}}{58 \text{ g NaCl}} \times \frac{1 \text{ mol Na}_2\text{SO}_4}{2 \text{ mol NaCl}} \times \frac{142 \text{ g Na}_2\text{SO}_4}{1 \text{ mol Na}_2\text{SO}_4} = 110.2 \text{ g Na}_2\text{SO}_4$$

17. If 100.0 grams of barium chloride react with sulfuric acid, how many grams of barium sulfate are produced?



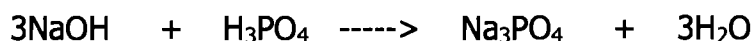
$$100 \text{ g BaCl}_2 \times \frac{1 \text{ mol BaCl}_2}{207 \text{ g BaCl}_2} \times \frac{1 \text{ mol BaSO}_4}{1 \text{ mol BaCl}_2} \times \frac{233 \text{ g BaSO}_4}{1 \text{ mol BaSO}_4} = 112.6 \text{ g BaSO}_4$$

18. How many grams of oxygen will be produced by decomposing 480 grams of potassium chlorate?



$$480 \text{ g KClO}_3 \times \frac{1 \text{ mol KClO}_3}{122 \text{ g KClO}_3} \times \frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} \times \frac{32 \text{ g O}_2}{1 \text{ mol O}_2} = 188.8 \text{ g O}_2$$

19. How many grams of sodium hydroxide will react with 150 grams of phosphoric acid?



$$150\text{g H}_3\text{PO}_4 \times \frac{1\text{mol H}_3\text{PO}_4}{98\text{g H}_3\text{PO}_4} \times \frac{3\text{mol NaOH}}{1\text{mol H}_3\text{PO}_4} \times \frac{40\text{g NaOH}}{1\text{mol NaOH}} =$$

183.7g  
NaOH

20. If 120 grams of mercury (II) oxide are decomposed by heat, what volume of oxygen is produced?



$$120\text{g HgO} \times \frac{1\text{mol HgO}}{217\text{g HgO}} \times \frac{1\text{mol O}_2}{2\text{mol HgO}} \times \frac{22.4\text{LO}_2}{1\text{mol O}_2} =$$

6.2LO<sub>2</sub>

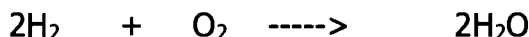
21. In the production of methanol, how many liters of hydrogen are needed to react with 500 liters of carbon monoxide?



$$500\text{L CO} \times \frac{1\text{mol CO}}{22.4\text{L CO}} \times \frac{2\text{mol H}_2}{1\text{mol CO}} \times \frac{22.4\text{L H}_2}{1\text{mol H}_2} =$$

1000L  
H<sub>2</sub>

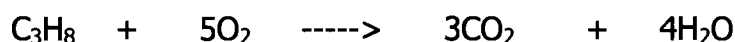
22. To produce water, how many liters of oxygen are needed to react with 600 liters of hydrogen?



$$600\text{L H}_2 \times \frac{1\text{mol H}_2}{22.4\text{L H}_2} \times \frac{1\text{mol O}_2}{2\text{mol H}_2} \times \frac{22.4\text{LO}_2}{1\text{mol O}_2} =$$

300LO<sub>2</sub>

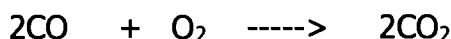
23. If 200 liters of propane are burned, what volume of carbon dioxide is produced?



$$200\text{L C}_3\text{H}_8 \times \frac{1\text{mol C}_3\text{H}_8}{22.4\text{L C}_3\text{H}_8} \times \frac{3\text{mol CO}_2}{1\text{mol C}_3\text{H}_8} \times \frac{22.4\text{L CO}_2}{1\text{mol CO}_2} =$$

600L CO<sub>2</sub>

24. How many liters of carbon dioxide do oxidizing 500 liters of carbon monoxide gas produce?



$$500\text{L CO} \times \frac{1\text{mol CO}}{22.4\text{L}} \times \frac{2\text{mol CO}_2}{2\text{mol CO}} \times \frac{22.4\text{L CO}_2}{1\text{mol CO}_2} =$$

500L CO<sub>2</sub>

25. How many liters of oxygen are needed to react with sulfur to produce 7000 liters of sulfur dioxide?



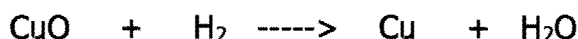
$$7000 \text{ L SO}_2 \times \frac{1 \text{ mol SO}_2}{22.4 \text{ L SO}_2} \times \frac{1 \text{ mol O}_2}{1 \text{ mol SO}_2} \times \frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} = \boxed{7000 \text{ L O}_2}$$

26. When 70 grams of hydrogen peroxide are decomposed by light, how many liters of oxygen are released?



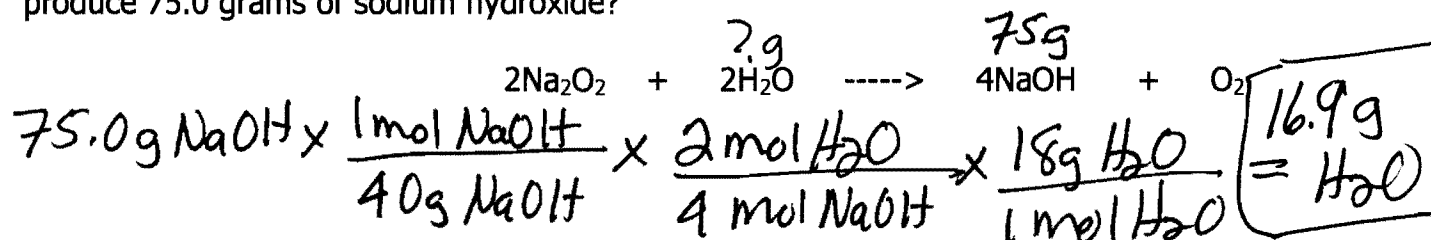
$$70 \text{ g H}_2\text{O}_2 \times \frac{1 \text{ mol H}_2\text{O}_2}{34 \text{ g H}_2\text{O}_2} \times \frac{1 \text{ mol O}_2}{2 \text{ mol H}_2\text{O}_2} \times \frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} = \boxed{23.0 \text{ L O}_2}$$

27. In the reduction of 100.0 grams of copper(II) oxide, how many liters of hydrogen are needed?



$$100 \text{ g CuO} \times \frac{1 \text{ mol CuO}}{79.5 \text{ g CuO}} \times \frac{1 \text{ mol H}_2}{1 \text{ mol CuO}} \times \frac{22.4 \text{ L H}_2}{1 \text{ mol H}_2} = \boxed{28.2 \text{ L H}_2}$$

28. How many grams of dihydrogen monoxide must react with sodium peroxide to produce 75.0 grams of sodium hydroxide?



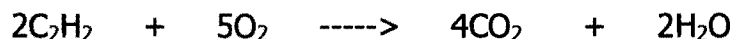
$$75.0 \text{ g NaOH} \times \frac{1 \text{ mol NaOH}}{40 \text{ g NaOH}} \times \frac{2 \text{ mol H}_2\text{O}}{4 \text{ mol NaOH}} \times \frac{18 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = \boxed{16.9 \text{ g H}_2\text{O}}$$

29. In the Haber process for making ammonia, how many liters of ammonia gas are produced when 4600 liters of nitrogen gas is used?



$$4600 \text{ L} \times \frac{1 \text{ mol N}_2}{22.4 \text{ L N}_2} \times \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} \times \frac{22.4 \text{ L NH}_3}{1 \text{ mol NH}_3} = \boxed{9200 \text{ L NH}_3}$$

30. How many liters of oxygen are required to completely burn 800 liters of acetylene gas?



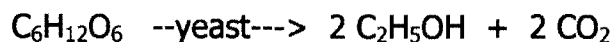
$$800 \text{ L C}_2\text{H}_2 \times \frac{1 \text{ mol C}_2\text{H}_2}{22.4 \text{ L C}_2\text{H}_2} \times \frac{5 \text{ mol O}_2}{2 \text{ mol C}_2\text{H}_2} \times \frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} = \boxed{2000 \text{ L O}_2}$$

$$56222 \text{ mL}$$

$$44978 \text{ g} \times \frac{1 \text{ mL}}{0.8 \text{ g}} =$$

31. In the fermentation process, glucose can be converted to ethanol. How many milliliters of ethanol will be produced if 88000 gm of glucose are fermented?

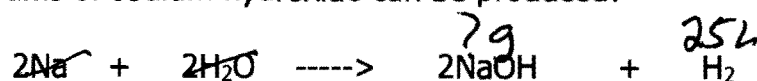
(HINT: 1. find the number of grams of ethanol 2. Then use 0.8 g/mL to convert grams to mL.)



$$44978 \text{ g EtOH}$$

$$88000 \text{ glucose} \times \frac{1 \text{ mol glucose}}{180 \text{ g glucose}} \times \frac{2 \text{ mol EtOH}}{1 \text{ mol glucose}} \times \frac{46 \text{ g EtOH}}{1 \text{ mol EtOH}} =$$

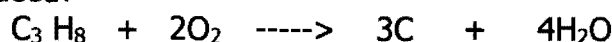
32. If 25 liters of hydrogen are produced by the reaction of sodium metal and water, how many grams of sodium hydroxide can be produced?



$$89.3 \text{ g NaOH}$$

$$25 \text{ L H}_2 \times \frac{1 \text{ mol H}_2}{22.4 \text{ L}} \times \frac{2 \text{ mol NaOH}}{1 \text{ mol H}_2} \times \frac{40 \text{ g NaOH}}{1 \text{ mol NaOH}} =$$

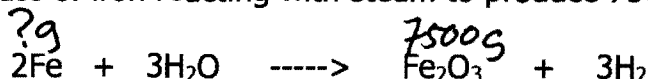
33. During the incomplete combustion of 7000 L of propane, how many grams of soot (C) are produced?



$$11250 \text{ g C}$$

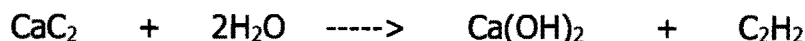
$$7000 \text{ L C}_3\text{H}_8 \times \frac{1 \text{ mol C}_3\text{H}_8}{22.4 \text{ L C}_3\text{H}_8} \times \frac{3 \text{ mol C}}{1 \text{ mol C}_3\text{H}_8} \times \frac{12 \text{ g C}}{1 \text{ mol C}} =$$

34. Calculate the mass of iron reacting with steam to produce 7500 grams of rust (Fe<sub>2</sub>O<sub>3</sub>)



$$7500 \text{ g Fe}_2\text{O}_3 \times \frac{1 \text{ mol Fe}_2\text{O}_3}{160 \text{ g Fe}_2\text{O}_3} \times \frac{2 \text{ mol Fe}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{56 \text{ g Fe}}{1 \text{ mol Fe}} =$$

35. If 500 grams of calcium carbide react with water, what volume of acetylene gas is produced?



$$500 \text{ g CaC}_2 \times \frac{1 \text{ mol CaC}_2}{64 \text{ g CaC}_2} \times \frac{1 \text{ mol C}_2\text{H}_2}{1 \text{ mol CaC}_2} \times \frac{22.4 \text{ L C}_2\text{H}_2}{1 \text{ mol C}_2\text{H}_2} =$$